ENQUIRY-BASED LEARNING IN ENGINEERING CURRICULUM:

Are we preparing graduates ready to face future challenges?

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Outline

- Drivers
- Approach
- Does it work?
- Concluding remarks

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Drivers

IChemE Technical Roadmap, 2012

Approach

- To review the teaching of chemical engineering Ug degrees to ensure that the curriculum is:
  - Compliant with external requirements (assessments, ILO), IChemE, InstMC & EI accreditation
  - Relevant to chemical engineers of the future
  - Integrated across years/subjects
  - Effective for larger cohorts of students
- Review started in 2007 taking into account input from all stakeholders

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Process

- ✓ Core curriculum design group convened (DPDs, industrial representative, staff with external experience) and facilitated by QuiLT rep
- ✓ Overview of UK competitor degrees, consultation where appropriate
- ✓ Consultations as detailed in next slide
- ✓ Feedback from Faculty
- ✓ Establishing a focus group of practising industrialists
- ✓ Away day
- ✓ Subject groups lead by future module leaders
- ✓ Preparation of the required documentation

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Consultations

- ✓ Accreditation discussions with IChemE
- ✓ Consultation with the External examiner
- ✓ HEA workshops on Enquiry based learning, assessment and feedback, curriculum review and ILO
- ✓ Observation of PBL in the Medical faculty, detailed discussions on the process, advantages, problems
- ✓ Meeting with student representatives on SSC and BoS
- ✓ Questionnaire sent to recent past graduates in a range of industries (consultancy, specialty and bulk chemicals, procurement, petrochemicals, etc.)
- ✓ Meeting with practising chemical engineers from a range of industries
- ✓ Discussions with the Ug Dean and Faculty administrator

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Accreditation framework

	Master Level	Bachelor Level	Further Learning to Master Level
Underpinning Mathematics and Science	20	20	
Core Chemical Engineering	85	85	
Engineering Practice	10	10	
Design Practice	10	10	
Embedded Learning (SHE, Sustainability)	Sufficient, clear demonstration#	Sufficient, clear demonstration#	Sufficient, clear demonstration#
Embedded Learning (Transferable Skills)	Sufficient, clear demonstration#	Sufficient, clear demonstration#	Sufficient, clear demonstration#
Advanced Chemical Engineering - Depth	30		30
Advanced Chemical Engineering - Breadth	15		15
Advanced Chemical Engineering Practice	10		10
Advanced Chemical Engineering Design Practice	5		5
Total IChemE Specified Content	185	125	60

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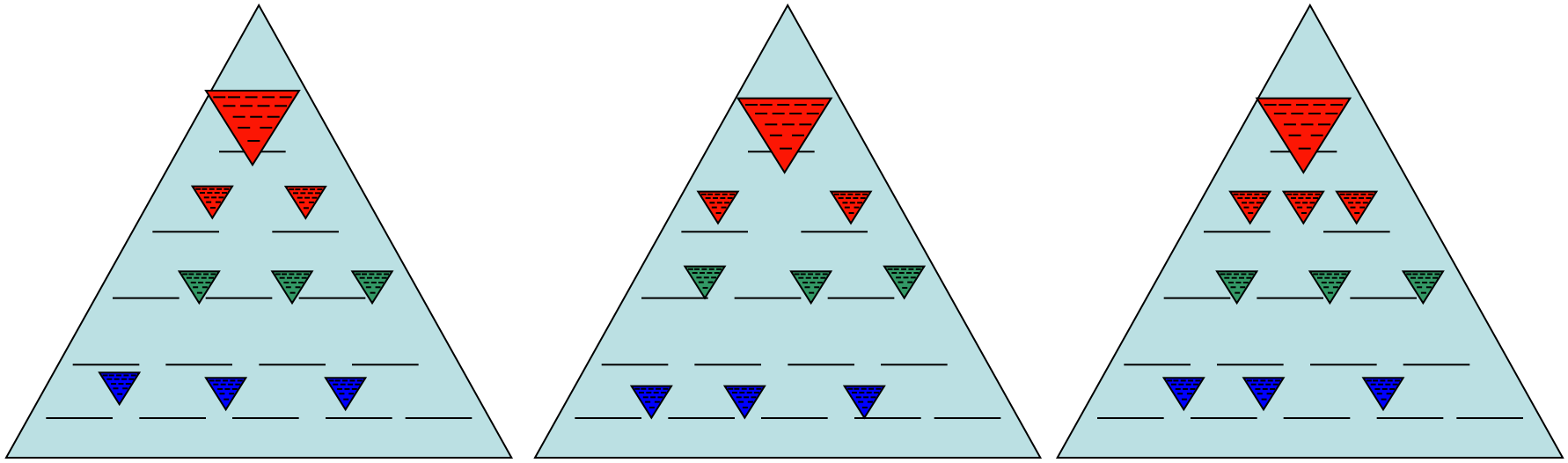
Broad areas of chem. eng. employment

Design Engineering

Operations & Management

Process/Product Development



- Case studies in different stages, integrating different subjects, culminating in the design project

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Case studies - benefits

- Critical to the aims of the curriculum restructuring
- Linking knowledge from a number of modules as well as developing professional skills in ‘real life’ scenarios
- Small group learning promoting problem solving, team working, initiative & leadership/negotiation skills, computing skills, data synthesis and critical analysis
- Assessment via more appropriate forms – reports (including reflective individual reports) and presentations promoting the development of presentation and report writing skills
- Promoting independence of learning and peer assisted learning

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Case studies –requirements

- Realistic case study scenarios – input of industrial contacts
- Development of case studies in student-friendly format
- Small group learning space
- Relevant computing packages and support
- Staff buy-in – restructuring lecture material in relevant modules so that it links closely with case studies (on demand) is seen as critical to the success of this scheme
- Transition to a different mode of delivery will require a period of adjustment and more support to both staff and students

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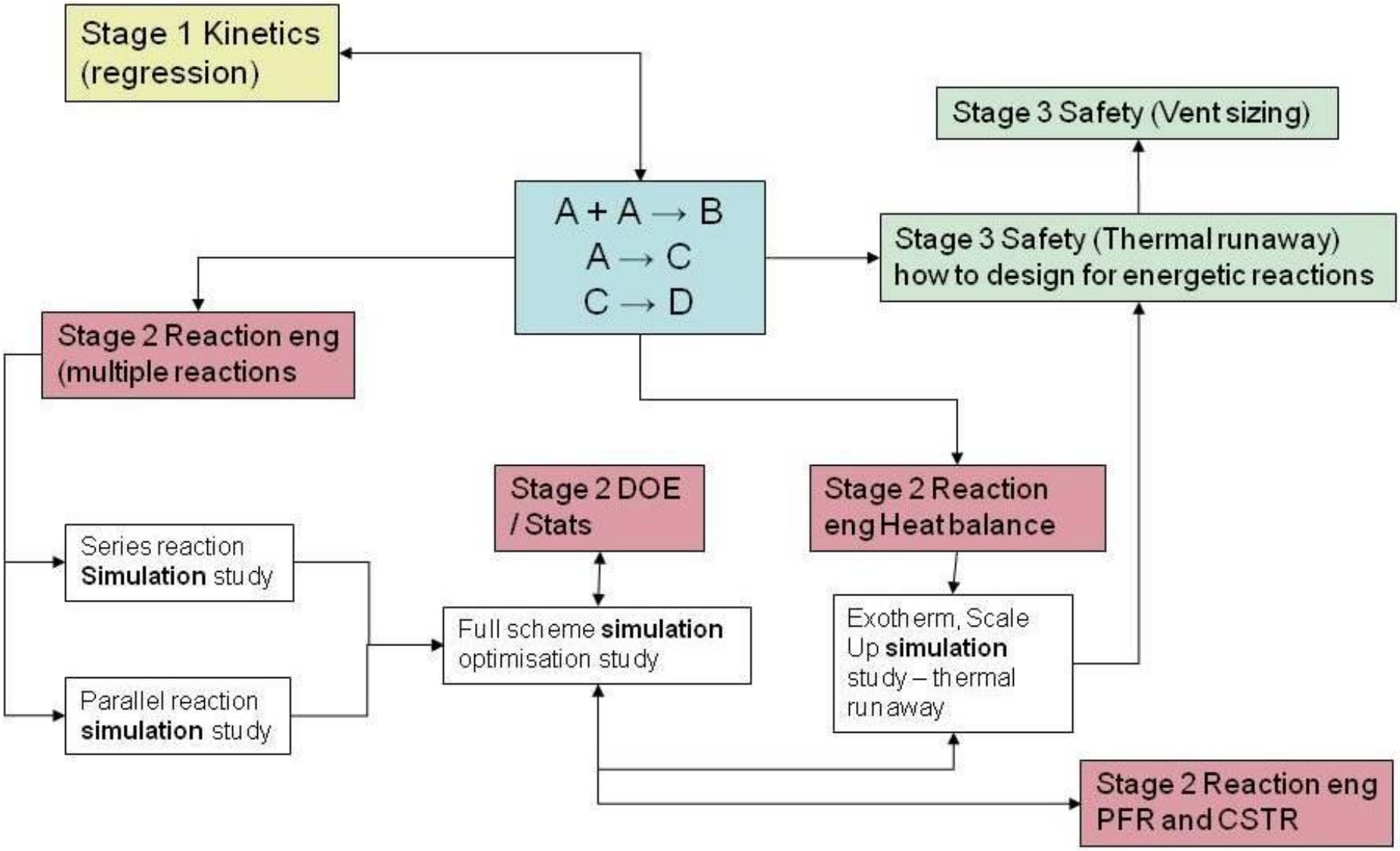
Case study example – Stage 1

Case study example – Stage 2



Does it work?

- Student focus groups on the effectiveness of different methods – diamond ranking
- Questionnaires on case study on reaction engineering in Stage 2 (66 students, 53 responding)
- Analysis of the self-reflection reports from case study in Stage 1 (103 reports analysed)

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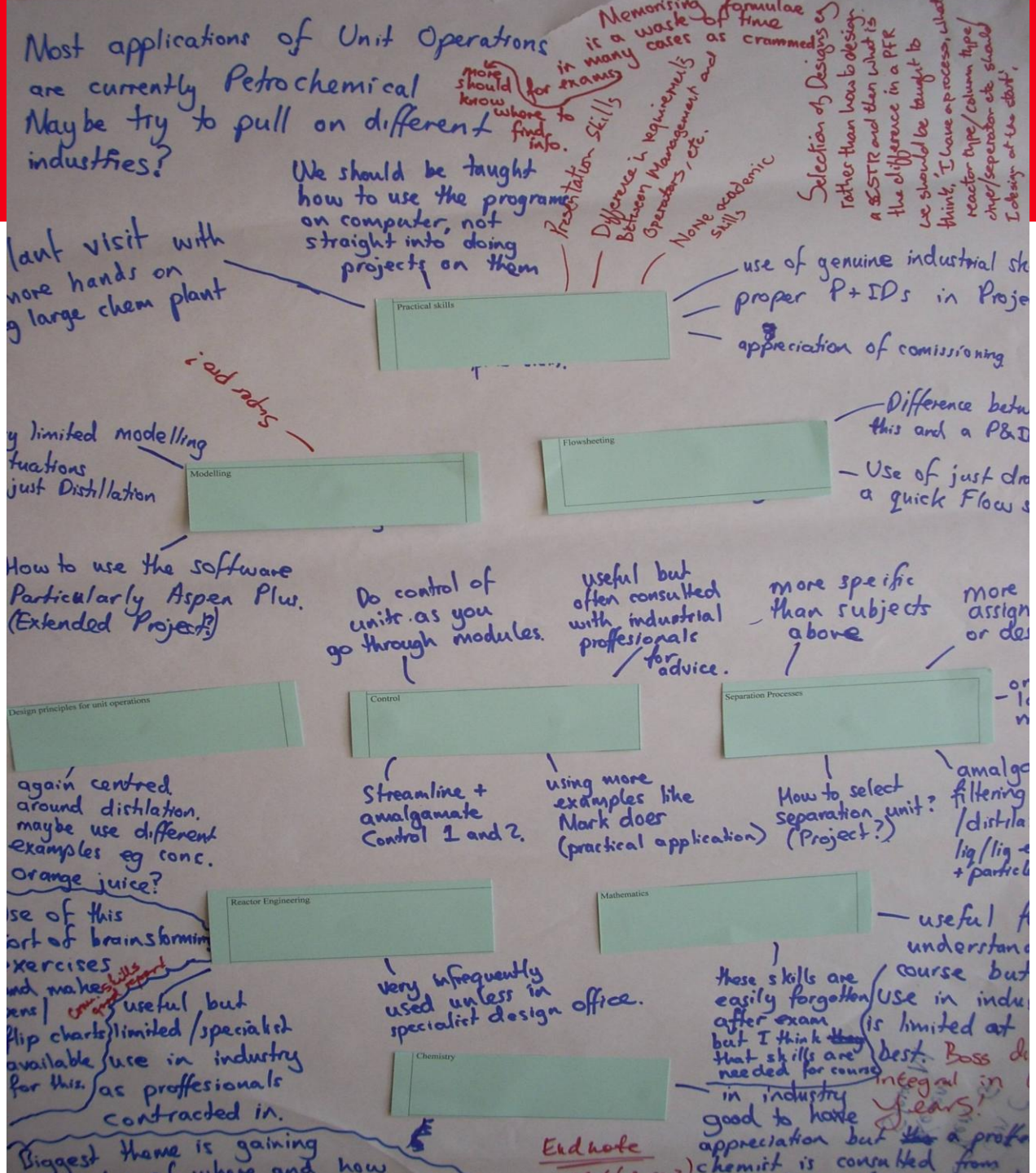

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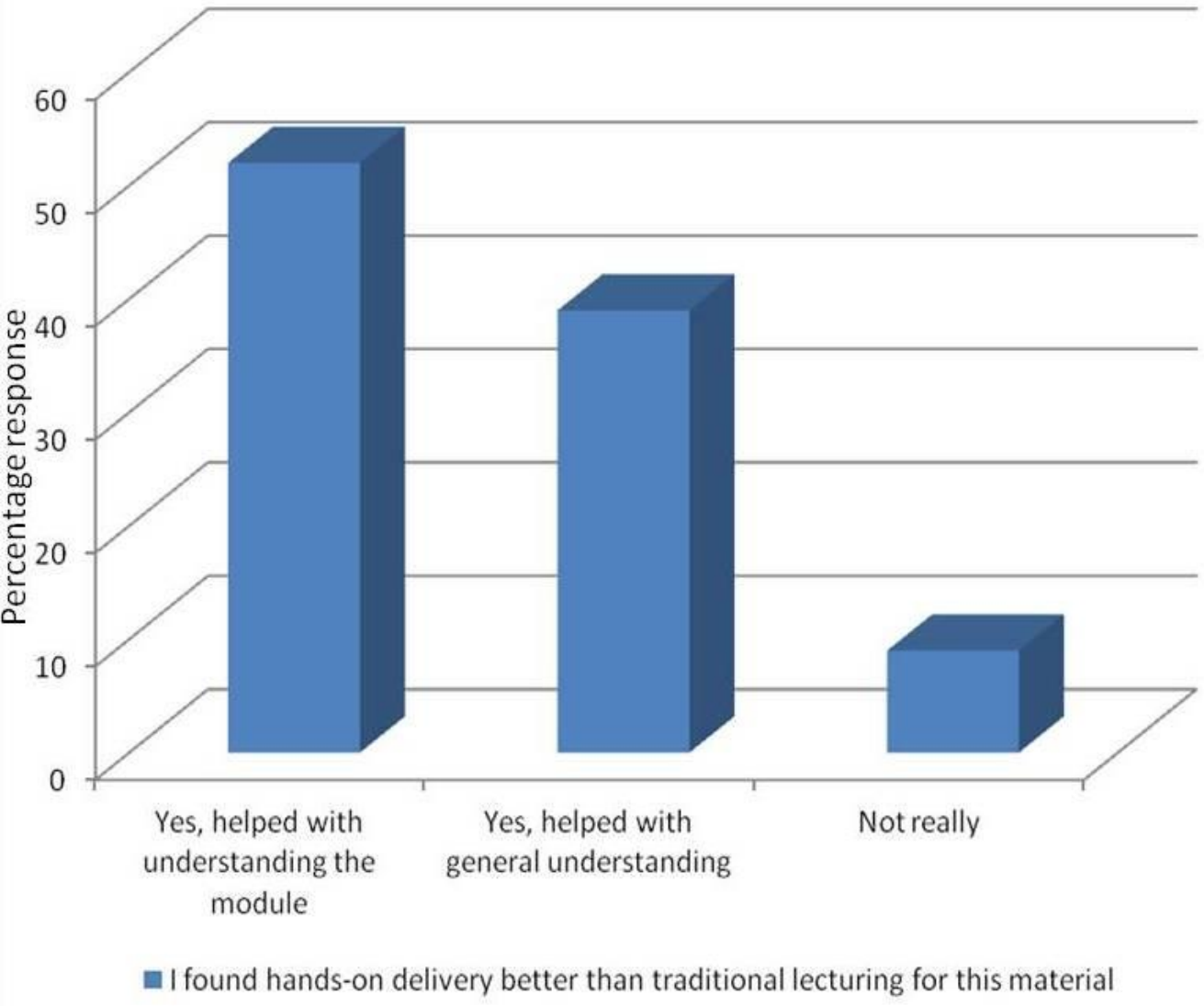
Stage 2 case study



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Evaluation of self-reflective reports

…Unfortunately I did not feel like our group worked well towards the start of the project. Ho

… I was a pretty terrible group member if I'm honest, I wasn't very good ttending meetings, and

…I honestly enjoyed working with such a group in which I have never thought that working on a case study or a report with a group would be easy and fun and would have no conflict such as this group

…we just met for the year enrolment and the fact that everyone comes from a different backgrounds. The thought of having hard time mixing around would always bug me up, but fortunately we all able to understand the situation…

Concluding remarks

- All stages of BEng course now revised with Stage 4 currently being finalised for MEng courses
- First BEng graduates from the revised course graduated this summer
- EBL taking both lecturers and students out of their comfort zone, but reinforcing in-depth learning of principles and professional skills
- Long-term process requiring full commitment and continuous re-evaluation

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- Thanks to all CEAM colleagues (academic and admin alike) involved in the curriculum re-structuring
- Thank you for your attention